DOE SSL Commercial Product Testing Program (CPTP)

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Voices for SSL Efficiency: DOE SSL Workshop

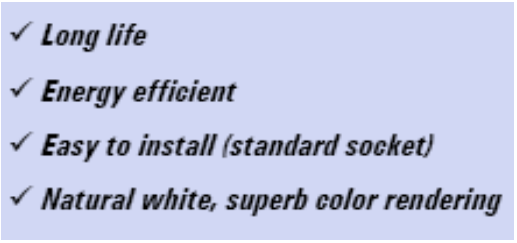
Boston

Outline: Commercial Product Testing Program

- Purposes of CPTP
- Testing program scope
- Methods & process
- Progress to date
- Round 1 & 2 results
- Where to go for more info

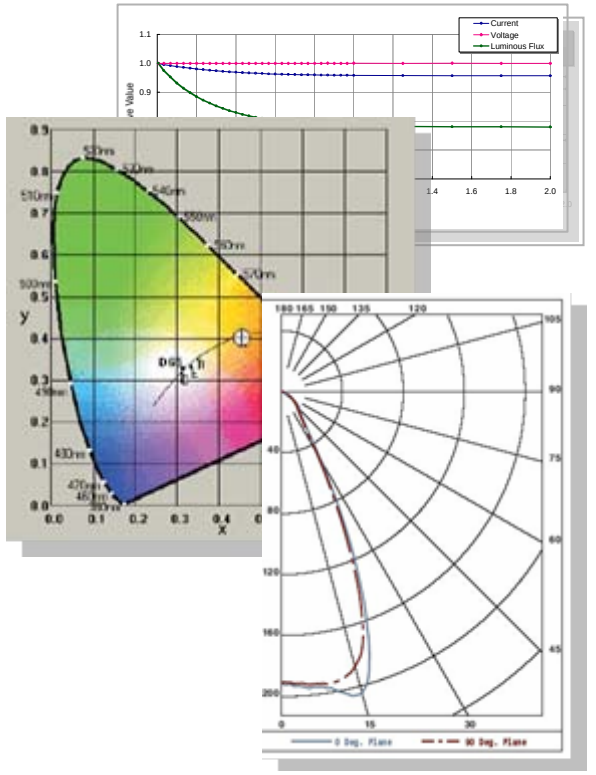
Purposes of CPTP

- Provide objective, high quality performance information
- Know performance of market available products
  - To support R & D planning
  - To support ENERGY STAR®
- Inform industry test procedures and standards development
- Discourage low quality products
- Reduce SSL market risk due to buyer dissatisfaction from products that do not perform as claimed



Testing Program Scope

- Commercially-available SSL products for the general illumination market
  - Luminaires (white light)
  - Indoor and outdoor
  - Residential and commercial
- Testing for
  - Luminaire light output, efficacy
  - Power, thermal characteristics
  - Beam and intensity
  - Lumen depreciation
  - Spectral power distribution, CCT, CRI
  - Benchmarking (other light sources)



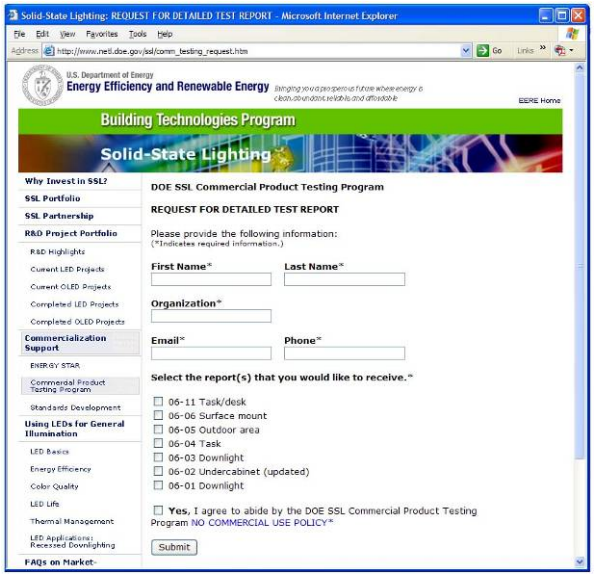
Testing Program Process

- Quarterly product selection & acquisition
- Multiple independent test labs
- Assembly and analysis of results
  - Courtesy sharing of results with manufacturers
  - Retesting options
- Publication of results
  - Summary reports
  - Detailed test reports
- “No Commercial Use” Policy


Photo credit: Luminaire Testing Laboratory

Progress to Date

- Quarterly rounds of testing
  - Selection → Acquisition → Testing → Analysis → Reports
- Current Status
  - Pilot testing completed
  - Round 1 completed
  - Round 2 completed
  - Round 3 testing underway
  - Round 4 selection commencing



CPTP Round 1 & 2 Results

- 25 products tested
- Focus: overall luminaire performance
- Wide range in products & results
- Small sample size, more testing Round 3

Examples of CPTP Results

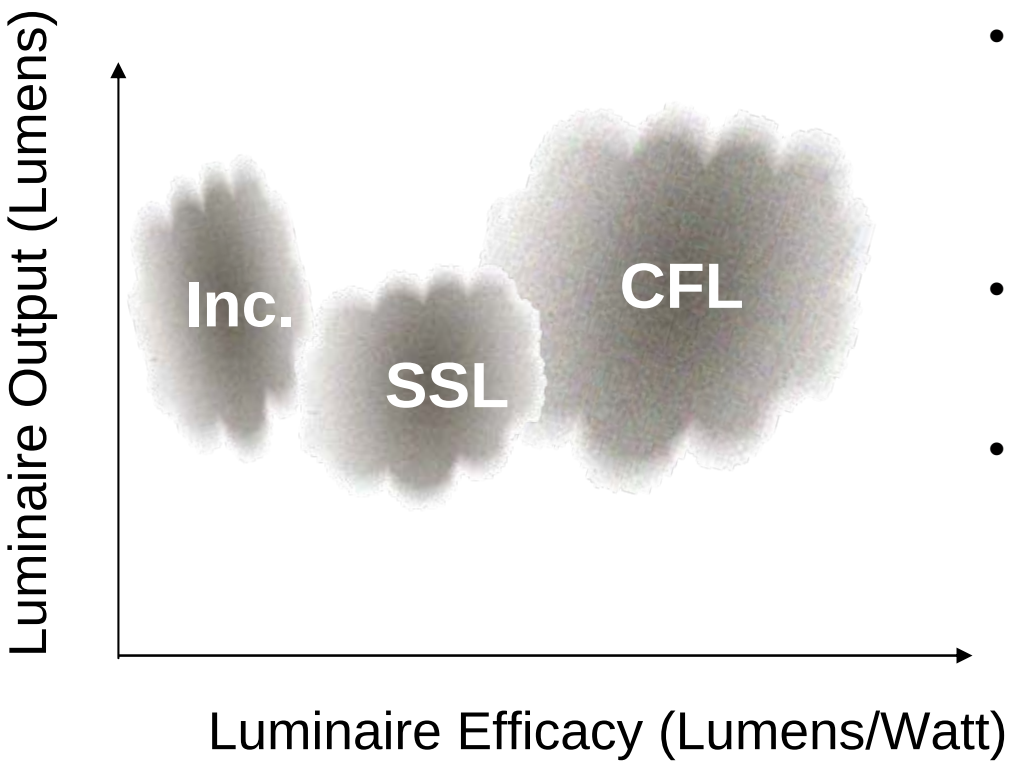
	Manufacturer Published LED Luminous Efficacy	Light Output (lumens)	Luminaire Efficacy (lm/W)	Correlated Color Temperature (K)	Color Rendering Index
SSL Downlights					
CPTP 06-01	*40 lm/W*	193	12.8	3012	70
CPTP 06-03	*45 lm/W*	298	19.4	2724	67.3
SSL Undercabinets					
CPTP 06-02	*55 lm/W*	166	16.1	3483	78.2
CPTP 06-08		375	21.6	7003	72.3
CPTP 06-10		166	32.8 [21.9]	4103	77.3
SSL Task/Desk Lights					
CPTP 06-04	*36 lm/W*	114	11.6 [7.1]	6392	76
CPTP 06-09		328	15.3 [11.6]	3841	84.9
CPTP 06-11		215	17.0 [8.2]	5973	74
CPTP 07-03		226	18.4 [8.6]	5939	74

Adjusted efficacy values in brackets [] include the effect of measured off-state power consumption assuming 3 hours on-time per day.

Examples of CPTP Results

DOWNLIGHTS					
	Manufacturer Published Output or Efficacy	**Output (lumens)**	**Efficacy (lm/W)**	**Correlated Color Temperature (K)**	**Color Rendering Index**
R30 Replacement Lamps					
CPTP 07-08, Warm White	*400 lm*	239.1	27.1	2945	71.8
CPTP 07-09, Cool White	*500 lm*	310.3	34.1	5973	81.9
CPTP 07-13, Warm White, RGB	*400 lm*	405.6	25.9	2689	14.45
CPTP 07-14, Cool White, RGB	*400 lm*	351.6	25.4	4006	13.3
Downlights (complete luminaires)					
CPTP 06-01, Downlight	*40 lm/W (LED)*	193	12.8	3012	70.0
CPTP 06-03, Downlight	*45 lm/W (LED)*	298	19.4	2724	67.3
CPTP 07-04, Downlight	*477 lm*	356.7	11.6	5964	76.4
CPTP 07-05, Downlight	*642 lm*	662.2	25.3	4402	76.0
A-lamp Replacement Lamps					
CPTP 07-06, A19	*27 lm*	10.3	15.7	3161	70.4
CPTP 07-12, A-lamp (~A17)	*"Electricity consumption reduced 80-90%"*	19.7	13.4	25263	79.1

Energy Use and Light Output



General Observations

- Luminaire outputs: comparable for some applications
  - Undercabinets
  - Desk/Task
- Luminaire efficacies
  - SSL surpasses incandescent
  - SSL→ ½ to ¾ CFL
- Caution:
  - Small sample size
  - SSL evolving
  - More benchmarking
  - More testing

Direct CFL/LED Comparison

- Same desk/task light, two different sources

	CFL	LED
Luminaire Output (lm)	236	226
Luminaire Efficacy (lm/W)	24.2	18.4
CCT	3432	5939
CRI	79	74
Power Factor	0.54	0.92

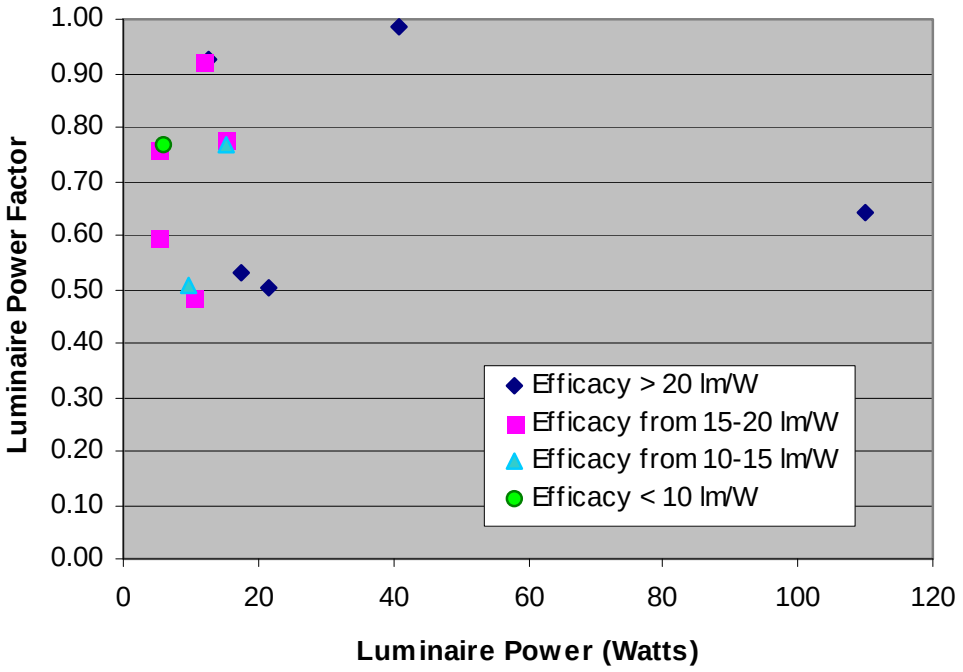
Off-State Power Concern

- Luminaires with on-off switches
  - 18 lm/W → 9 lm/W (for 3 hours on per day)

Table 2. Effective Average Efficacy						
		Measured Efficacy w/ Power On (lm/W)	Measured Power in Off State (W)	Effective Average Efficacy (lm/W)		
				1 hour on per day	3 hours on per day	5 hours on per day
CPTP 06-04 Task Light		11.6	0.88	3.8	7.1	8.7
CPTP 06-09 Task/Desk		15.3	0.98	7.4	11.6	13.0
CPTP 06-10 Undercabinet		32.8	0.36	12.4	21.9	25.8
CPTP 06-11 Task/Desk		17.0	1.96	3.7	8.2	10.7
CPTP 07-02 Task/Desk	*CFL*	24.2	1.14	6.6	13.3	16.8
CPTP 07-03 Task/Desk	LED	18.4	2.00	3.9	8.6	11.4
Note that units operated for fewer hours per year will consume less energy, despite lower efficacies.						

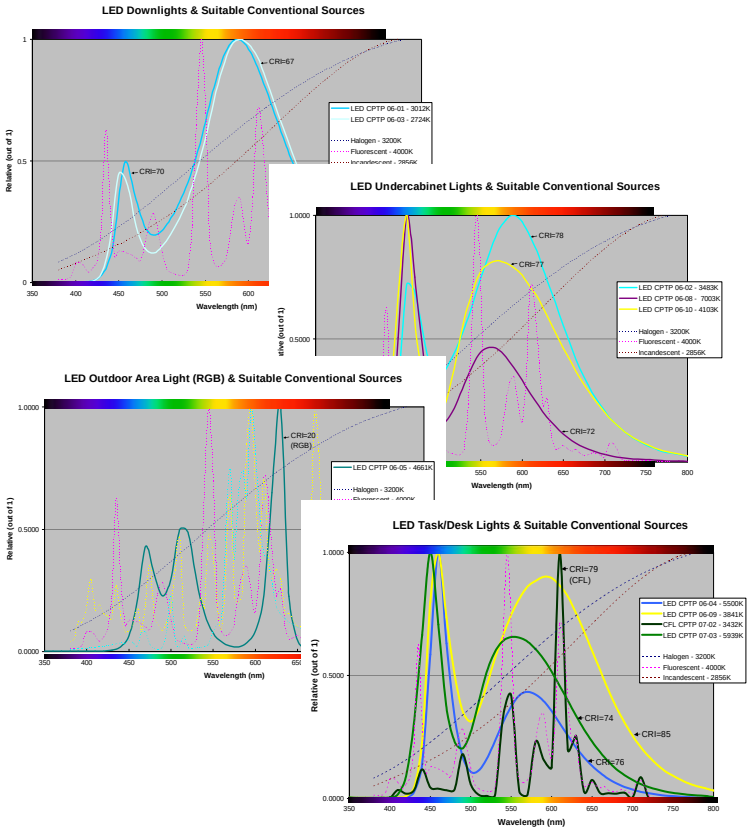
Round 1 Results: Power Factors

- Range of values
  - 0.5 to 1.0
- Small sample size for now
  - No PF/efficacy correlation
  - No PF/power correlation



Round 1 & 2 Results: Color Qualities

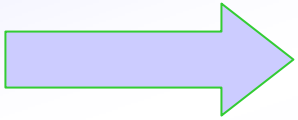
- Range of color qualities
  - CCT range: 2689 K to 36000 K
  - Phosphor-conversion LEDs CRI range: 67-85
  - Three RGB luminaires tested



CPTP Round 1 & 2 Key Conclusions

- Wide range of performance in SSL luminaires
  - Misleading product literature
- CPTP positive influences
  - Market/industry awareness & involvement
  - Testing standards validation & refinement

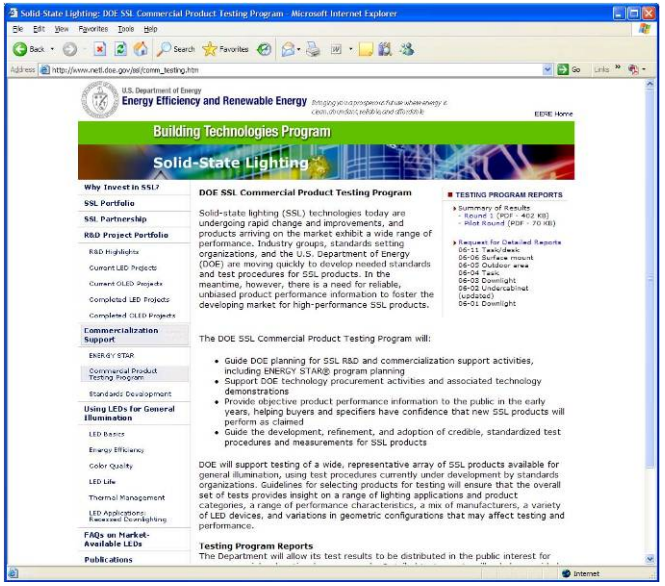
Round 1 & 2 products designed in 2005-2006, showing some LED luminaires rivaling some CFL luminaires in output and efficacy



Great promise for next generation of commercially available SSL luminaires

More Info on CPTP

- Via website
  - Summary reports
  - Detailed reports
    - Must be requested via web form
    - Requestor's contact information must be provided
    - Must agree to adhere to 'No Commercial Use Policy'



http://www.netl.doe.gov/ssl/comm_testing.htm

No Commercial Use Policy

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Questions & Answers

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